United States
Department of
Agriculture

Forest
Service

February
2017

Burnt Corral Vegetation Project

Botany Report

North Kaibab Ranger District, Kaibab National Forest
Coconino County, Arizona

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Table of Contents

Introduction 4
Description of Proposed Action 4
Legal Framework 5
    Forest Plan Direction 5
Methodology and Analysis Process 6
Threatened, Endangered, Proposed, and Candidate Species 6
Sensitive Species 6
  Mt. Dellenbaugh Sandwort 7
    Existing Condition 7
  Arizona (clustered) Leatherflower 7
    Existing Condition 7
  Arizona Phlox 8
    Existing Condition 8
Analysis of Effect to Sensitive Plants 8
Determination of Effects 9
Rare and Narrow Endemic Species 9
  Mitigation Measures 10
Cumulative Effects 10
Literature Cited 11

Introduction

Plant communities in the western United States have been dramatically altered by fire exclusion, overgrazing by livestock, and selective timber harvesting; all of which have combined to form highly dense and unhealthy forests. Increased ponderosa pine density has resulted in a significant loss of the herbaceous understory due to alterations in resource allocation within the stand, which can adversely affect both structural and functional properties of the forest understory (Laughlin et al. 2011, Stoddard et al. 2011). Ecological restoration can be applied to convert high-density ponderosa pine forests to an open canopy structure similar to that found at the time of Euro-American settlement (Moore et al. 2006), potentially reestablishing understory properties to near pre-settlement conditions (Stoddard et al. 2011). Forest thinning and prescribed burning are often proposed and implemented to reverse the undesirable changes in ponderosa pine forests in Arizona (Abella 2004). Forest thinning and prescribed burning can make resources (e.g., light, nutrients, and water) more readily available for understory plant species, and can aid in the restoration of ecosystem function and processes. Increasing resource availability can result in increased understory species abundance, vigor, and productivity, and potentially species richness (Griffis et al. 2001, Abella 2004, Moore et al. 2006, Laughlin et al. 2008, Stoddard 2011). The proposed restoration treatments would provide structural diversity to promote suitable habitat for a host of understory species with differing resource requirements (e.g., shade-tolerant vs. shade-intolerant), and would have the potential to increase the abundance of sensitive plant species.

The proposed action reduces tree densities and woody debris through mechanical and burning treatments throughout the project area. These treatments would have various impacts on plants as described above. However, these impacts would be less than a high intensity wildfire and the associated flooding/erosion if this action were not implemented. This document discusses the effects of the Burnt Corral Vegetation Management Project on Threatened, Endangered, and Sensitive plant species, and Rare, Narrow, and Endemic plant species.

Description of Proposed Action

The North Kaibab Ranger District (NKRD), through a collaborative process with interested stakeholders, proposes to mechanically thin about 15,000 acres and use wildland fire, alone or in conjunction with mechanical treatment, on about 28,000 acres, see Table 1and Figure 1 in Appendix A. The proposed action is based on consultation with diverse stakeholders and guided by a quantitative exploration of data that allowed explicit consideration of multiple values and perceived risks associated with this project and the earlier Kaibab Forest Health Focus. See the Environmental Assessment (EA) for details on the purpose and need for action and for full descriptions of the Proposed Action, mitigation measures, and desired conditions.

Table 1. Burnt Corral Vegetation Management Project treatments.

Treatment Type(s) Proposed	Relevant Strata	Maximum Estimated Acreage
Wildland Fire		
Fire only[1]	Ponderosa pine plantations, Bridger fire area, sensitive soils, steep slopes, seed cuts approaching desired conditions	11,530
Mechanical Thinning and Wildland Fire:		
Thin mixed conifer from below to 12"	Mexican Spotted Owl Habitat	360

[1] This includes activities such as preparation thinning and other light mechanical and hand thinning treatments associated with appropriate use and management of prescribed fire and managed wildfire.

Thin from below to 14”	Goshawk Nest Areas	2,520
Thin from below to 16”	Old Growth Ponderosa Pine	2,130
Create .5-3 acre early seral openings on 10%, thin to 80 basal area on 90%	Ponderosa Pine Creating Early Seral Openings	8,080
Thin to 80 basal area	Ponderosa Pine with Existing Early Seral Openings	3,470
Total Project Area		28,090

Legal Framework

Forest Plan Direction

Kaibab National Forest Plan Direction (2014) provides direction for Threatened, endangered and Sensitive Specie and Rare and Narrow Endemic Species (pages 51-53).

Desired Conditions for Threatened, Endangered, and Sensitive Species

- Threatened, endangered, and sensitive species have quality habitat, stable or increasing populations, and are at low risk for extirpation.

Guidelines for Threatened, Endangered, and Sensitive Species

- Project activities and special uses occurring within federally listed species habitat should integrate habitat management objectives and species protection measures from approved recovery plans.
- Project activities and special uses should be designed and implemented to maintain refugia and critical life cycle needs of Forest Service Sensitive Species.

Rare and Narrow Endemic Species

Some of the rare and narrow endemic species face threats by virtue of their relatively limited distribution. Species (or subspecies) are considered to have a restricted distribution if they are limited in extent in the Southwest. A species is considered to be a rare and narrow endemic if it has extremely limited distribution and/or habitat in northern Arizona. Due to limited distributions and potential susceptibility to perturbations, some species may require specific management considerations. On the Kaibab NF there are currently 74 known species for which restricted distribution is considered a threat; of these, 48 are narrow endemics, some of which are on the Regional Forester’s *sensitive species list.*

Desired Conditions for Rare and Narrow Endemic Species

- Habitat and refugia are present for narrow endemics or species with restricted distributions and/or declining populations.
- Location and conditions of rare and narrow endemic species are known.

Guidelines for Rare and Narrow Endemic Species

- Project design should incorporate measures to protect and provide for rare and narrow endemic species where they occur.

Management Approach for Rare and Narrow Endemic Species

- Species-specific information and management recommendations can be found in the Kaibab endemic species guidebook, which is to be maintained as a living document. This guidebook will be updated with new information and locations as they become available.

Methodology and Analysis Process

A review was conducted to determine if threatened, endangered, potential, and sensitive species and the rare and endemic plants occur or habitat exist within or near the project area. A summary of this review is presented in the tables below. The following references were used: USFWS list of Threatened, Endangered, Proposed, Candidate, and Conservation Agreement species occurring in Coconino and/or Yavapai Counties; Arizona Game and Fish Department Heritage Data Management System; USDA Forest Service Region 3 Rare Species List; Arizona Rare Plant Field Guide; and Southwest Environmental Information Network.

Threatened, Endangered, Proposed, and Candidate Species

There is only one Federally listed plant species on the NKRD, Fickeisen plains cactus (Pediocactus peeblesianus var. fickeiseniae), listed as endangered on October 31, 2013. This species and it's designated Critical Habitat on the NKRD only occurs on the rim of South Canyon on the NKRD and is not within or adjacent to the project area.

Sensitive Species

There are 18 plant species on the USDA R3 Regional Forester's Sensitive Species 2013 list that occur on the Kaibab NF. The Forest has developed a list (Kaibab 2014) that breaks down the range of species by district. Table 1 shows the species listed for the NKRD. Sensitive wildlife species will be discussed in a separate document. All other species on the Forest list do not occur on the NKRD and will not be impacted by the proposed project.

Table 1. Sensitive Species for the Kaibab National Forest that could or do occur within the Burnt Corral project boundary

Species	Comments	Species or Habitat in Project Area?
Mt. Dellenbaugh sandwort *Arenaria aberrans*	Rocky habitats of ridges and canyon rims in oak and pine forests but also found in pinyon and juniper, 5500 – 9000 ft, South, north, and northeast aspects, sandy soil in Coconino County.	**Habitat**
Gumbo milkvetch *Astragalus ampullarius*	Grows in restricted habitat of clay, saline, seleniferous soils of the Chinle and Moenkopi formations. Known from only one locality on the NKRD in desert scrub vegetation.	No
Marble Canyon milkvetch *Astragalus cremnophylax var. hevionii*	Occurs in Great Basin desert scrub habitat, on rim-rock benches at the canyon edge in crevices and depressions with shallow soils on Kaibab Limestone. 5,200-5,400'. Presently known only from the Navajo Nation on the east rim of Marble Canyon. No known sites on Forest, but may occur on the NKRD's rocky benches on canyon edges of Marble Canyon.	No
Cliff milkvetch *Astragalus cremnophylax var. myrorrhaphis*	Grows in crevices and depressions with shallow soils (or no soil), on Kaibab Limestone on rim-rock benches, cliff ledges and flat-topped pinnacles at the canyon edge. Typically on points, which extend out from canyon edge escarpment beyond detritus, which slough from talus slopes. May also occur on vertical canyon walls below these points. Generally at 6,200' elevation, but up to 7,900'. Known populations on NKRD's canyon edges.	No
Kaibab paintbrush *Castilleja kaibabensis*	Fine silts and clays to rocky gravelly meadow soils derived from weathered Kaibab limestone, on low rounded ridge tops and small knolls; populations occur in driest most exposed sites in the open meadows. 8,200-9,000'. Known populations on NKRD's high elevation meadows.	No
Arizona (clustered) leatherflower *Clematis*	Rocky hillsides in open to dense ponderosa pine with slopes from 12% to 40% and aspects from 320° to 40°, 7000-8500 ft, limestone soils with few populations on basalt, Known populations on North Kaibab Ranger District	**Habitat**

Species	Comments	Species or Habitat in Project Area?
hirsutissima var. hirsutissima		
Morton wild buckwheat *Eriogonum mortonianm*	Usually along small drainages in red clay hills of very shallow gypseous soils on sandstone and shale uplands. 4,650'. Red gypseous sandy-clay derived from Moenkopi Formation outcrops. Not found on forest but habitat may exist on NKRD in this soil type. Limiting factors/threats: rarity, highway maintenance, and grazing.	No
Atwood wild buckwheat *Eriogonum thompsonae var. atwoodii*	Usually along small drainages in red clay/gypsum hills. 4,400-4,700'. Near Fredonia: shallow soils on red clay hills of Moenkopi sandstone and shales. Near Lost Spring Mountain: red gypsum loam. Not found on forest but habitat may exist on NKRD in this soil type. Limiting factors/threats: rarity, highway maintenance, brush clearing, and ORV's.	No
Kaibab bladderpod *Lesquerella kaibabensis*	On limestone-clay knolls with a high percentage of exposed rock on the surface, within open windswept meadows. 8,350-8,860'. Found on NKRD high elevation mountain meadows. Limiting factors/threats: rarity, highway maintenance, and grazing.	No
Kaibab pincushion cactus *Pediocactus paradinei*	Grows in grassy openings in pinyon-juniper woodland and shrub grasslands. 5,000-7,000'. Conservation agreement with FWS on management of species. Occurs on the east side of NKRD. Limiting factors/threats: rarity, small mammal predation, fire, loss of natural fire regime, and collecting.	No
Arizona phlox *Phlox amabilis*	Open, exposed limestone or basalt rocky slopes within pinyon-juniper and ponderosa pine/gambel oak, Known populations on the North Rim of the Grand Canyon and Williams and Tusayan Ranger Districts	**Habitat**
Grand Canyon rose *Rosa stellata spp. abyssa*	All known populations are on or near canyon rims or the tops of cliffs at the edges of mesas or plateaus, along low ledges at depressions caused by breccia pipes. Kanab Canyon: rim on low limestone breaks and in small, shallow drainages. Twin Point: on deeper soils along west edge, Kaibab limestone bedrock outcropping in places. 4,500-7,540'. Limestone-red clay soils. Gravelly soils derived from Tinoweap Kaibab limestone. Known populations exist in Kanab Creek on the NKRD. Habitat exists on cliff edges on NKRD and TRD. Limiting factors/threats: rarity, wildlife grazing, and mining.	No

Mt. Dellenbaugh Sandwort

Existing Condition

Mt. Dellenbaugh sandwort only occurs in Arizona in rocky habitats of ridges and canyon rims in oak and pine forests between 5500 – 9000 feet in elevation (AZGFD 2004). This sandwort prefers north, south, or northeast facing slopes and may be found growing in pinyon-juniper habitats (Kaibab 2014b). There are no known locations of this sandwort on the KNF but suitable habitat is available (Kaibab 2014b). SEINet reports this sandwort being collected in DeMotte meadow in 1929. Oak and pine forest occurs on the southern and western end of the project area. Rocky ridges are exposed on the western edge of the project where the Bridger-Knoll fire burned in 1996. Limiting factors and threats to Mt. Dellenbaugh sandwort is rarity. The exposed rocky ridges within the Bridger-Knoll Fire scar within the Burnt Corral project area receives fire only treatments under the proposed action. There are no known locations of Mt. Dellenbaugh sandwort in this area.

Arizona (clustered) Leatherflower

Existing Condition

The Arizona (clustered) leatherflower grows on rocky hillsides in open to dense ponderosa pine forests with slopes up to 40% and aspects from 320° to 40° (Kaibab 2014b). Most known populations are at 7000 – 8500 feet in

elevation on limestone soils but a few are on basalt soils (Kaibab 2014b). Limiting factors and threats to Arizona (clustered) leatherflower are logging, recreation, and land development. There are known populations of this leatherflower on the NKRD. In 1984, leatherflowers were observed in DeMotte meadow and along the 610 rd just north of the park boundary. Suitable habitat is across most of the ponderosa pine component of the project area (about 21,000 acres); however there are no known locations within the project area.

Arizona Phlox

Existing Condition

Arizona phlox grows on open, exposed limestone or basalt rocky slopes in pinyon-juniper and ponderosa pine/gambel oak (Kaibab 2014b). Limiting factors and threats to Arizona phlox are grazing and fire. There are known populations of this phlox on the north rim of the Grand Canyon (Kaibab 2014b, SEINet 2015) and suitable habitat within the Burnt Corral project boundary. The southern end of the project has pockets of pine/oak and the western side, burned in the Bridger-Knoll fire of 1996, has exposed limestone edges. There are no known populations of Arizona phlox in the project area.

Analysis of Effect to Sensitive Plants

Direct effects from the project would include loss of individual plants or population groups through management actions. Factors contributing to these effects would include disturbance from management actions such as activities associated with tree removal and prescribed fire.

Mechanical treatments would provide structural diversity to promote suitable habitat for a host of understory species with differing resource requirements (e.g., shade-tolerant vs. shade-intolerant), and may increase the abundance of sensitive plant species. Although little is known about the ecology, it is thought that Mt. Dellenbaugh sandwort prefers forest openings; therefore it would be expected that reductions in tree densities would favor this species.

Changes in the amount of sunlight available for plants could have positive or negative effects to sensitive species depending on the amount of change produced by management actions. In another leatherflower, Maschinski et al, 1997 found that high levels of light may lead to increased vegetative growth, but lower reproduction and seedling survival.

Given that these species evolved in a fire-adapted ecosystem, it is unlikely that prescribed fire of low to moderate intensities would negatively affect species viability.

Deep litter may negatively affect the plants but removal of all litter from the site would have adverse effects on juvenile plants, these effects would be mitigated by burning under conditions that would reduce the litter layer without removing it entirely.

Short-term effects of burning include mortality of individual plants. Long-term effects include the loss of shade from tree mortality or reduction in the amount of litter that would be detrimental to juvenile plants, which need some litter to retain moisture around them. This would be mitigated by managing burning at intensities low enough to limit mortality to trees and preserve a light layer of litter.

Prescribed fire has the potential to expand the current abundance and distribution of sensitive plant species by enhancing structural (e.g., variable shading) and functional (e.g., nutrient flow) ecosystem properties.

An indirect effect of management actions includes an increased risk of invasion from noxious or invasive weeds. These effects would be mitigated by incorporating the Best Management Practices described in of Final Environmental Impact Statement for the Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab and Prescott National Forests (2005). Incorporation of the Best Management Practices would mitigate the effects of increased disturbance from management activities, and help to control the spread and introduction of weeds. For additional analysis of non-native and invasive plant species impact see the Non-Native and Invasive Plant Species Specialist Report (2016).

Determination of Effects

Mechanical treatments and prescribed fire may affect sensitive plant species individuals, but is not likely to contribute to a trend toward federal listing or a loss of species viability because of their relatively limited occurrence or absence within the project area and the implementation of mitigation measures.

Rare and Narrow Endemic Species

The proposed action may affect individuals of rare or endemic plant species, but it will have no measurable negative impact on the population because of their limited occurrences within the project area, and the implementation of mitigation measures listed below that are designed to protect known and newly discovered populations.

Table 2. Rare and Narrow Endemic Species for the Kaibab National Forest that could or do occur within the Burnt Corral project boundary

Species	Habitat	**Species or Habitat in project area?**
Colorado blue columbine *Aquilegia caerulea var. pinetorum*	Rare – aspen with mesic mixed conifer and spruce fir and seeps, 5700-9000 ft	**Habitat**
Groundcover milkwetch *Astragalus humistratus var. tenerrimus*	Endemic – ponderosa pine and spruce fir, limestone-derived soils, 7800-8700 ft, locally abundant with large populations south of Jacob Lake and has been found south of the Grand Canyon and Flagstaff	**Habitat**
Silver milkvetch *Astragalus subcinereus*	Rare – open meadows and beneath trees in ponderosa pine, white fir, pinyon-juniper, aspen, and sagebrush, level terrain and slopes, 1400-2700 m, Known locations throughout NKRD and south of Tusayan	**Habitat**
Wright's bird's-beak *Cordylanthus wrightii spp. Kaibabensis*	Rare – pinyon-juniper, ponderosa pine, and sagebrush, 7220 ft, limestone with grass and shrubs, Found on North Kaibab Ranger District	**Habitat**
Arizona bladderpod *Lesquerella arizonica*	Rare- sandy and gravelly soils, limey knolls or limestone chip, open stands of sagebrush-pinyon, pinyon-juniper, Gambel oak, and sometimes ponderosa pine, 3200-7200 ft	**Habitat**
Macdougal's bluebells *Mertensia macdougalii*	Rare – montane willow riparian forest and ponderosa pine, variety of substrates, 6000-9000 ft, Known sites on rims of the Grand Canyon and Bill Williams Mountain	**Habitat**
Kaibab beardtongue *Penstemon pseudoputus*	Endemic – ponderosa pine and montane supalpine grassland, limestone, basalt and sandstone, 6560-9500 ft, Found on North Kaibab Ranger District	**Habitat and Species**
Bearded cinquefoil *Potentilla crinite var lemmonii*	Endemic – ponderosa pine, 6800-8000, limestone and volcanic-derived soils, North Rim of Grand Canyon to Flagstaff	**Habitat**
Oregon buttercup *Ranunculus oreogenes*	Rare – ponderosa pine, 6000-8500, limestone, sand, and basalt, Known locations on the NKRD and Tusayan	**Habitat**

Mitigation Measures

Table 3. Common general and specific Forest Service management practices, potential impacts and mitigation actions for rare, narrow and endemic species.

General Activity	Management Action	Impacts	Mitigation Actions
Forest Management	Burning	Intense fires may destroy plants and organic soils in understory settings.	Cool fires may better support these populations, manage fire for low intensity.
Forest Management	Harvesting	Populations may be physically removed from activities.	Limit harvesting where practicable when populations exist.
Livestock Management	Grazing	Livestock presence may result in erosion, vegetation removal, introduction of nonnative plants, and reduced water quality	Limit grazing where practicable, possibly with fencing, where these populations occur.
Livestock Management	Trampling/crushing	Damage or destruction of plants, and soil erosion are possible	Limit grazing where practicable, possibly with fencing, where these populations occur.
Pest Management	Nonnative plant species treatment (either mechanical or herbicide)	Unintentional treatment and the reduction or elimination of vegetation may increase erosion.	Ensure herbicides are safely handled to prevent unanticipated impacts on non-target flora.
Water Resources Management	Spring/stream/lake/ pond water availability and quality	Reductions in water availability or quality may adversely affect plants.	Monitor populations. Strive to limit activities in close proximity to populations that are adjacent to water resources/
Recreation	Off road vehicle recreational uses	Soil disturbances leading to erosion and possibly loss of plants	Strive to limit vehicle access in vicinity of known populations

Cumulative Effects

The cumulative impacts that could affect Sensitive and Rare and Endemic plants across the Burnt Corral Project Area over the next ten years include climate change, wildfires, invasive species, and travel management.

Climate Change

Climate change could affect the distribution of vegetation in general by affecting biotic and abiotic factors and by increasing the extent and severity of disturbances (USDA Forest Service 2010). Rare and sensitive species may be especially vulnerable because they often need specific habitat components such as specialized soil types that are not widely available. This could negatively affect their abilities to migrate to suitable areas as environmental conditions change. Water availability may decrease in some areas while temperatures generally increase. Alpine habitats may disappear entirely as elevational vegetation shifts occur (USDA Forest Service, 2010). Future plant distributions in general may be governed by several factors including human influences, abilities of plants to disperse, and the presence of suitable habitat components including such factors as suitable soil types (McKenney et al, 2007). Large changes in ecosystem structure and species composition of plant communities are expected due to increasing temperatures and altered precipitation cycles (USDA Forest Service, 2010). Species have responded to climate change throughout their evolutionary history, but not at rates seen in recent climate change (Root et al, 2003).

Phenology shifts in vegetation communities in large regions have been noted. These include shifts in the beginning, ending and length of growing seasons in temperate regions of the northern hemisphere. The results have been earlier emergence and blooming of flowering plants, extended end of season and longer growing seasons. Changes in growing season may affect climate by affecting surface radiation, temperature, hydrology and carbon cycling (Jeong et al, 2011). Trophic mismatches have been documented for several species (Parmesan, 2006) leading to disruption on symbiotic relationships and plant/animal interactions. In a review of many studies on climate change, Root et al, 2003 determined that "the balance of evidence for these studies strongly suggests that a significant impact to global warming is already discernible in animal and plant populations". Climate change coupled with other factors such as habitat loss could lead to extirpations and increased risks of extinction. Species generally respond to rapid climate change at differential rates. These differential movements may lead to loss of connectedness and loss of communities (Root et al, 2003). While the actions of this project will not mitigate widespread climate change, actions will provide more resiliency to our local vegetative communities, restore natural fire regimes and reduce the risk of habitat loss due to uncontrolled wildfire (see Fuels Specialist Report).

Fire

Years of fire suppression combined with climate change has led to an increasing number of high intensity wildfires in recent years. While fire historically played a key role in maintaining healthy ecosystem function, high intensity wildfires can dramatically alter an ecosystem by damaging or destroying plants and any potential seed in the soil. The disturbance created by these events leave burned areas lacking of native seed in the soil and open the door for new species to become established. This includes non-native invasive species that can rapidly establish and dominate a site within a few years after a fire.

Restoring Forests to fire adapted ecosystems will be an ongoing effort for the foreseeable future. Managed fires in conjunction with mechanical treatment can reduce heavy fuels, preventing catastrophic fires from occurring. When a fire occurs, the area is rested until the understory species have responded to the point being able to sustain grazing pressure. By reducing the potential for negative impacts to sensitive plant species and providing added rest options for the allotments, the long term survival of many plant species can be increased. Alternative 3 provides the greatest rest potential, followed by Alternative 1, and Alternative 2 then has the least amount of options to provide rest post fire.

Non-native invasive species

Non-native invasive species are continuing to invade and establish on federal lands at an alarming rate. These species are adapted to outcompete native species for nutrients and can rapidly establish and dominant sites. Invasive species pose a high risk to sensitive plant species and can displace them if left untreated.

The implementation of noxious and invasive weed control efforts has reduced the number of exotic plant species within the NKRD. The containment, control, and eradication of species like Scotch Thistle, Spotted Knapweed, and Cheatgrass is expected to continue for the foreseeable future. With these practices are guidelines for performing project activities that will reduce the risk of introduction of new invasive species and prevent the spread of undetected existing populations. There is no effect of herbicide treatments because they are not permitted at or immediately adjacent to these know plant populations and care is used in potential habitat areas to insure that new found plants are not affected.

Travel Management

The KNF implemented the Travel Management Rule in 2013. The cumulative effects to this and other species are the reduction in the numbers of motorized routes and the elimination of cross-country travel. Negative effects from motorized vehicles such as crushing of plants, damage to potential habitat such damage to soils, fragmentation of habitat and introduction of noxious or invasive weeds into the habitats and/or populations have been reduced. These reductions would be from the elimination of most cross-country travel and through the reduction of road density.

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